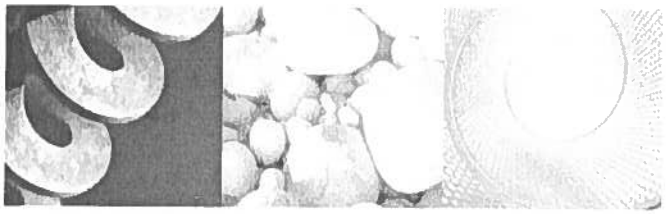
**WATERFRONT COMMITTEE MEETING**
**6:00 P.M., THURSDAY, OCTOBER 27, 2022**
**TOWN COUNCIL CHAMBERS**
**BUCKSPORT TOWN OFFICE**

This meeting will be held **IN PERSON**. It can also be viewed on local cable channel 1303 or on the internet by accessing townhallstreams.com and selecting Bucksport. Questions or comments may be submitted prior to or during the meeting by calling 469-7368

1. Call Meeting To Order
2. Roll Call
3. Discussion Item – Shorefront Assessment Report for Waterfront Walkway
4. Next Steps
5. Adjournment



GEI Consultants

Consulting
Engineers and
Scientists

**Shorefront Assessment Report**

# Waterfront Walkway

Penobscot River
Bucksport, Maine

**Submitted to:**
Town of Bucksport
50 Main Street
Bucksport, ME 04416

**Submitted by:**
GEI Consultants, Inc.
5 Milk Street
Portland, ME 04101
207-797-8901

September 26, 2022
Project 2201829

DRAFT

Travis J. Pryor, RLA / LEED-AP
Project Manager

Daniel J. Bannon, P.E.
Senior Project Engineer

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TJP:DJB

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# Executive Summary

## 1.1 Project Background

The Town of Bucksport is experience varying conditions of erosion from coastal exposure and upland runoff along its riverfront in the downtown area. The area of concern for the Town lies between Main Street, and the Penobscot River and runs the full length of the Waterfront Walkway. *(See Appendix A – Existing Erosion Areas of Concern Map)*

The Town retained the services of GEI Consultants, Inc. (GEI) to assess the shorefront and provide findings and recommendations for potential improvements to address the existing erosion issues. Additionally, this assessment identifies:

- Potential regulatory constraints and permits;
- Additional design development efforts required prior to implementation;
- Potential local, state and/or federal funding sources; and
- Planning level construction cost estimates for the Town's budgeting purposes.

## 1.2 Findings and Recommendations

Findings

The following findings are based on GEI's site visit and review of readily available resources:

- The shorefront surrounding the Waterfront Walkway in downtown Bucksport has been largely developed, with a mix of site features and uses including: buildings; paved access drives and parking lots; rail lines; park and greenspace; waterfront docking and piers; retaining walls; a vehicular bridge; a pedestrian bridge; subsurface utilities; a unit paver walkway; riprap shoreline; benches; signage; lighting; lawn areas with some shrubs, trees and perennial landscape beds; and other miscellaneous site amenities.

- The Waterfront Walkway is an approximate mile-long unit paver pedestrian path on Town properties or within public rights of way. The system was completed in phases after adoption of the 2003 Town Comprehensive Plan.

- The majority of the walkway is within the Federal Emergency Manage Agency (FEMA) 100-Year Flood Zone and is potentially subject to coastal flooding and future predicted sea level rise.

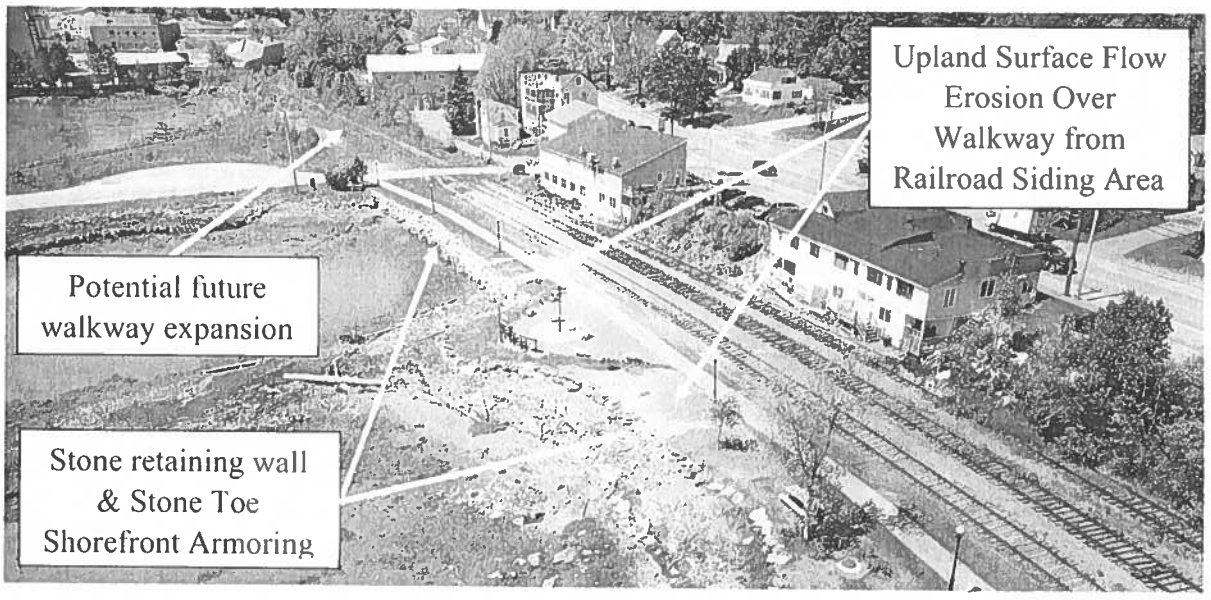
- Areas within FEMA Flood Zones, as well as the 250-foot shoreland zone, 75-foot setback from the highest annual tide line, and directly within the Penobscot River are subject to a variety of Local, State and Federal environmental regulations.

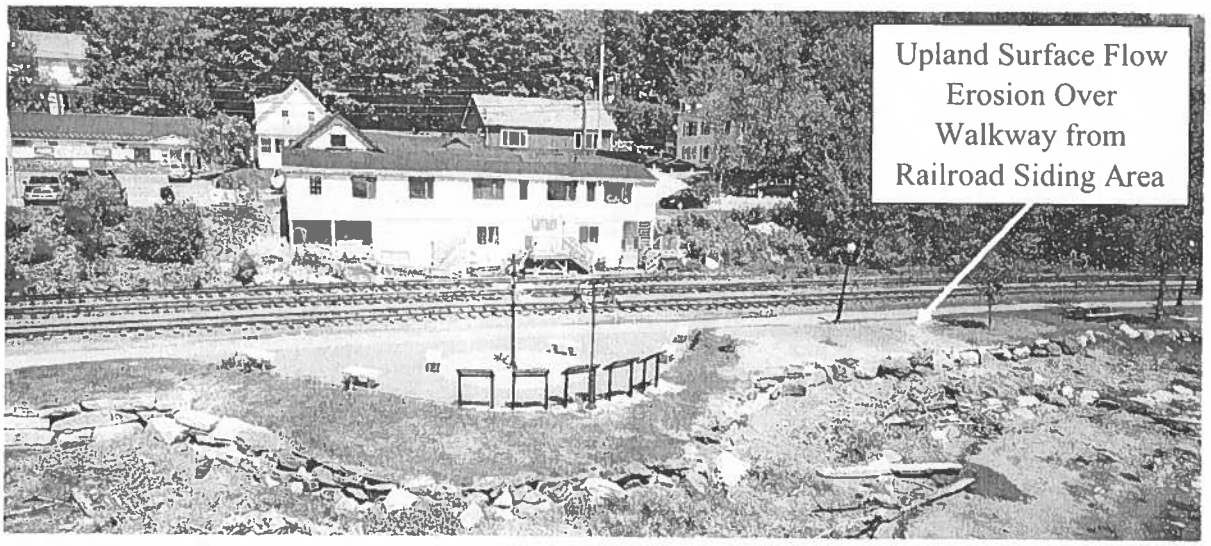
- Adjacent riprap shore frontage is generally in fair condition. Some minor erosion at the top of the riprap in adjacent lawn areas is occurring when either tidal waters periodically reach above the stone armoring, or when lawn areas have been lost, potentially due to mowing or prolonged drought conditions.

- The walkway and adjacent upland areas immediately above the riprap shorefront are experiencing various levels of erosion. The sources of these eroding conditions are upland properties contributing surface flows, and piped stormwater discharge onto and over the walkway, and from a downspout directly over the edge of the walkway where it passes under the Maine Department of Transportation's (MaineDOT) bridge to Verona Island.

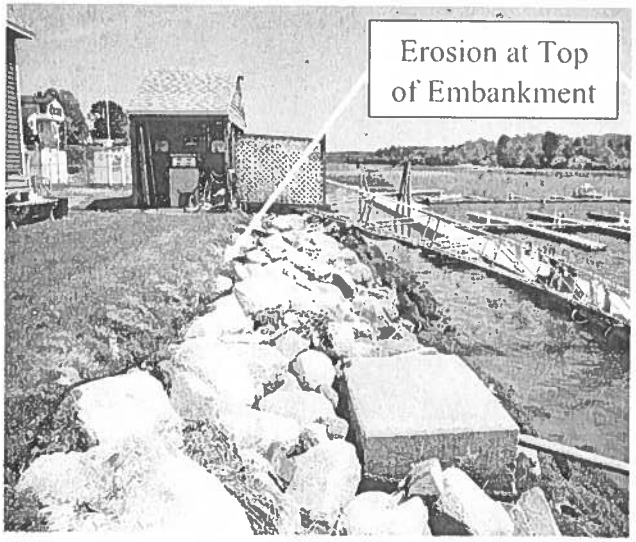
- The Town of Bucksport has engaged the Maine Department of Environmental Protection (MaineDEP), owners and representatives of the Irving Gas Station located at 31 US Route 1, and MaineDOT to discuss the recent erosion conditions. The Irving Gas Station made some site improvements in summer 2022 to address stormwater handling above the Waterfront Walkway.

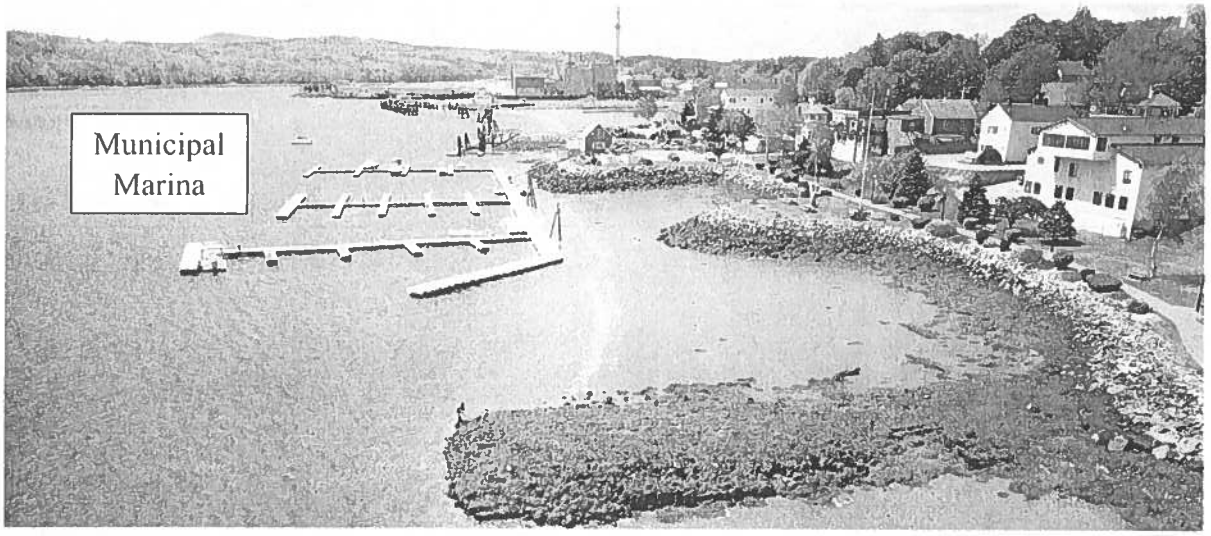
*The following photographs document the existing site conditions and highlight areas experiencing erosion, as well as other areas for potential shorefront stabilization improvements along the Waterfront Walkway. The majority of the images were obtained by GEI on May 25, 2022, with the last two images at the Irving Station provided by the Town of Bucksport on June 2, 2022.*

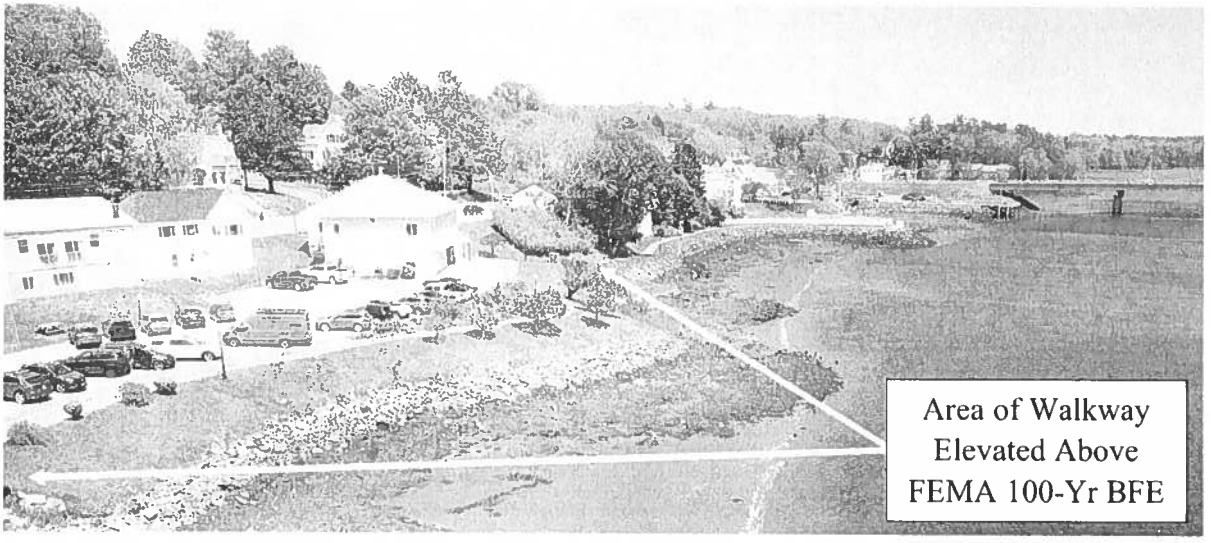


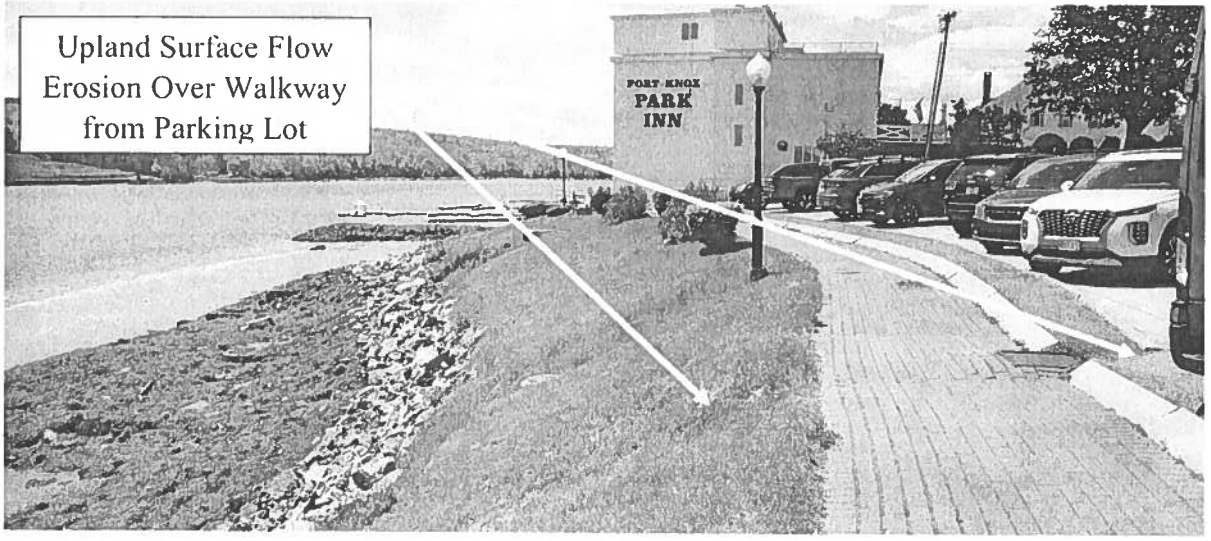

Upland Surface Flow
Erosion Over
Walkway from
Railroad Siding Area

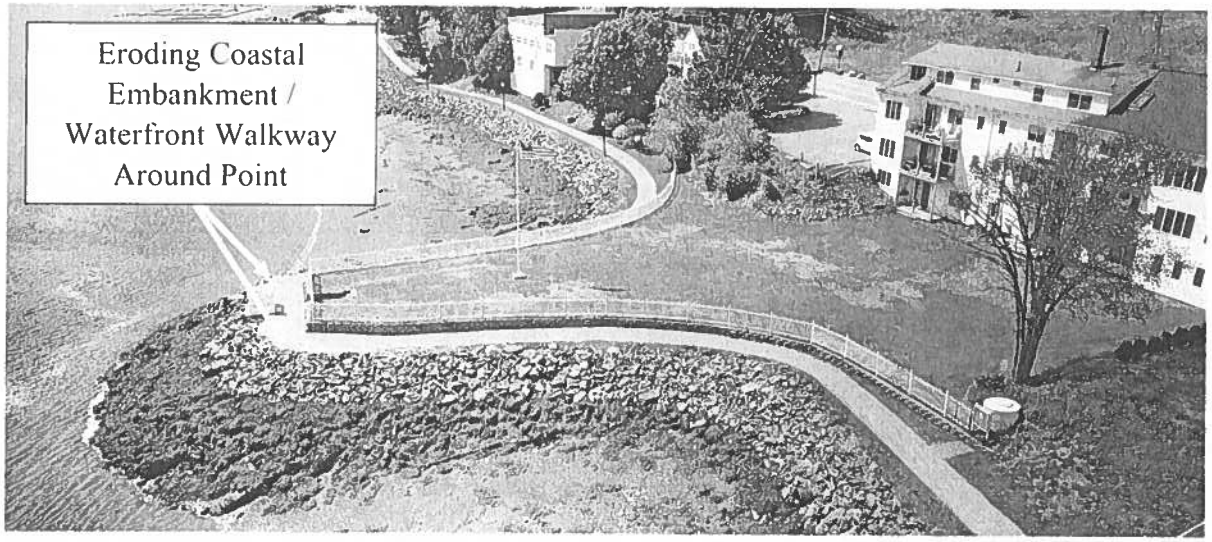

Municipal Marina

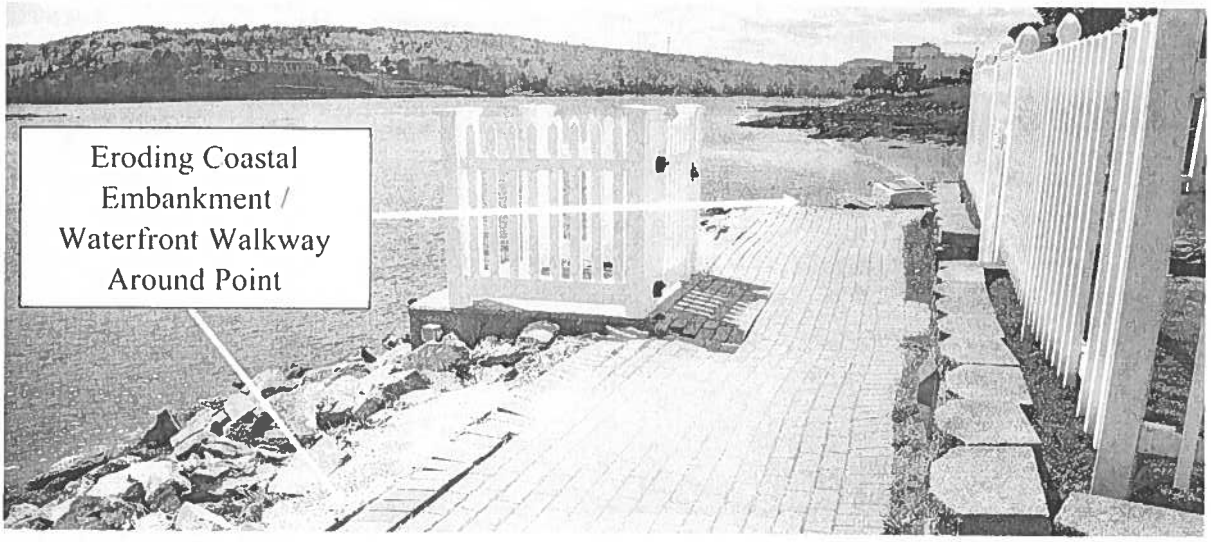

Erosion at Top
of Embankment

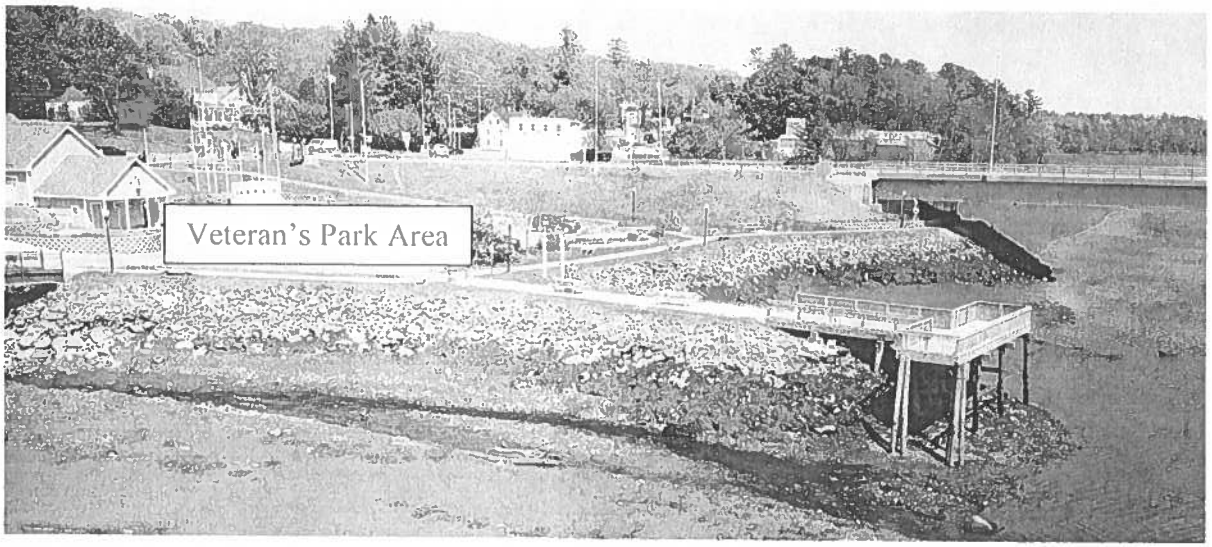

Municipal
Marina

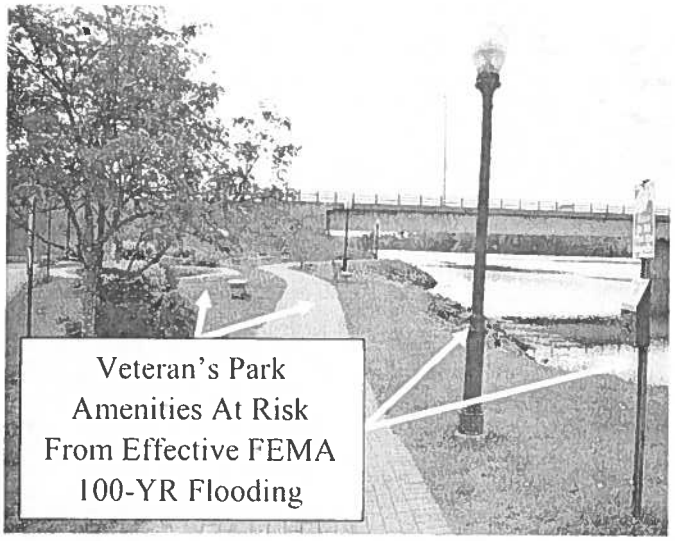

Area of Walkway
Elevated Above
FEMA 100-Yr BFE

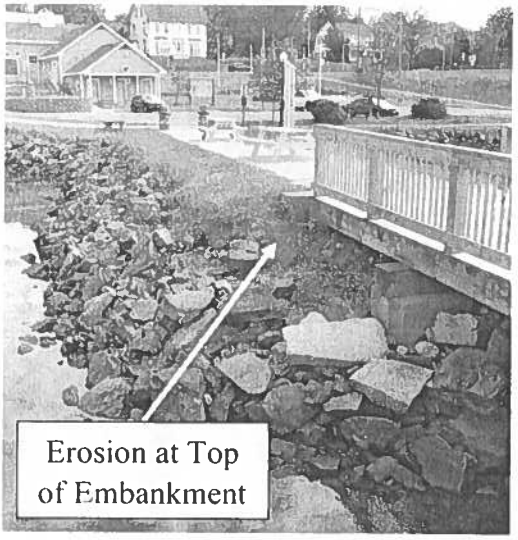

Upland Surface Flow
Erosion Over Walkway
from Parking Lot
PORT KNOX
PARK
INN


Eroding Coastal
Embankment /
Waterfront Walkway
Around Point

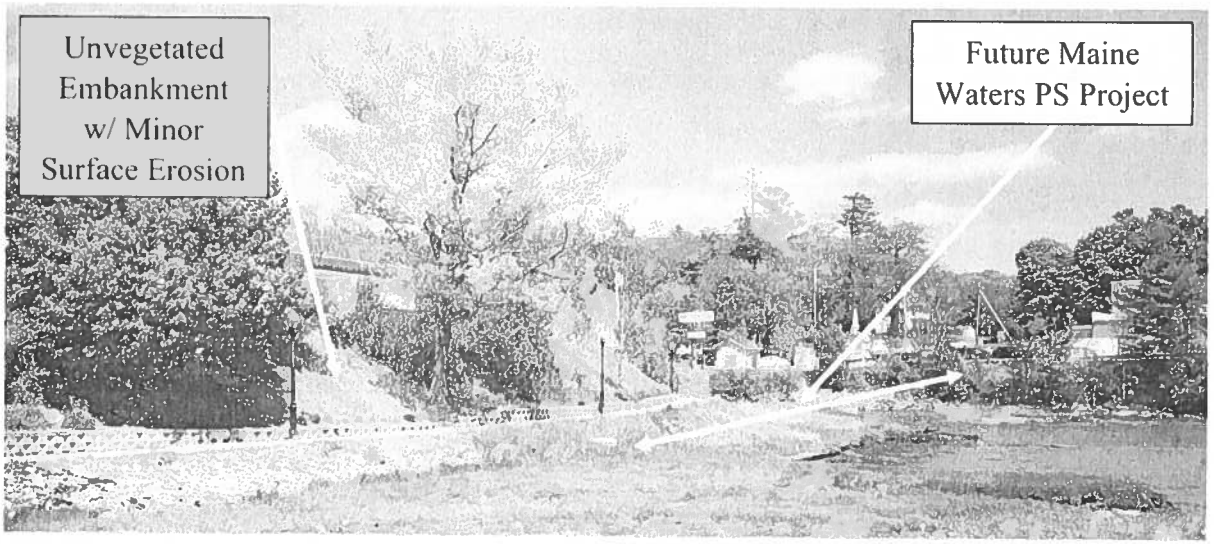

Eroding Coastal
Embankment /
Waterfront Walkway
Around Point

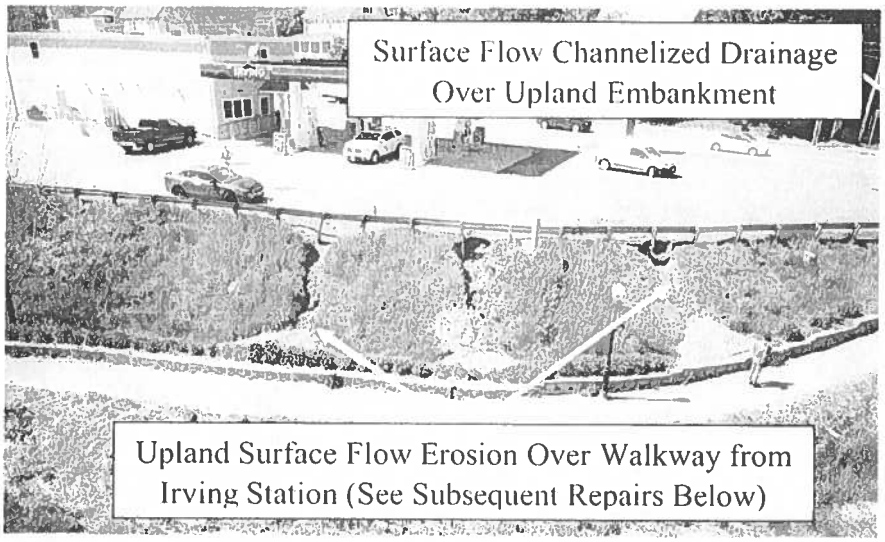

Veteran's Park Area


Veteran's Park
Amenities At Risk
From Effective FEMA
100-YR Flooding

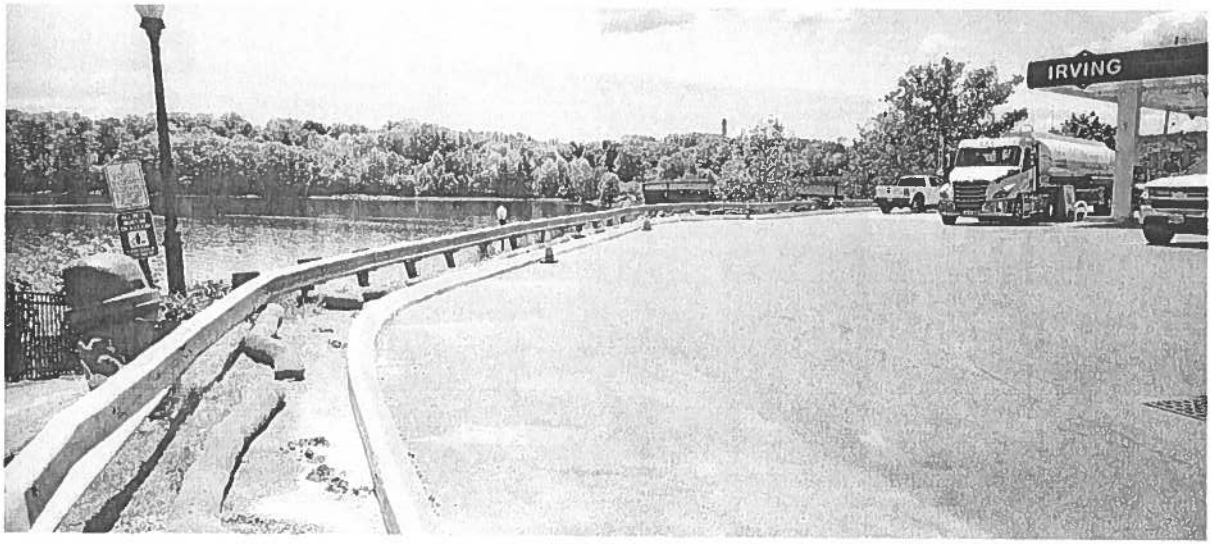

Erosion at Top
of Embankment


Route 1 Bridge
Downspout
Discharge
Eroding Coastal
Embankment
Small / Displaced
Coastal Embankment
Stone Armoring


Unvegetated
Embankment
w/ Minor
Surface Erosion
Future Maine
Waters PS Project




Upland Surface Flow Erosion Over Walkway from Irving Station (See Subsequent Repairs Below)



Recommendations

GEI recommends the following for the Town of Bucksport to consider for improvements to address erosion and shorefront stabilization:

*(See Appendix A – Recommended Improvement Areas Map)*

- Continue to work with upland contributors to erosion due to stormwater surface flows and piped discharge impacts. These improvements may require collaboration between the Town and the property owners, given conditions of easements and rights-of-way for the Waterfront Walkway where it crosses private property. If necessary and where applicable, local, state and/or federal regulatory enforcement may be required.

- Where upland stormwater surface flows and discharges are from public properties and public rights-of-way, GEI recommends intercepting the drainage above the walkway and discharging it through existing stormwater outfalls near the bottom of riprap armored shorefront areas.

- In addition to improvements to stormwater conveyance, the Town should consider replacing lawn areas and establishing a low growth vegetative buffer between the walkway and riprap shore frontage to prevent further erosion at the top of the riprap embankments.

- Beyond improvements to address erosion, the Town should consider opportunities to collaborate with other area improvements like Maine Waters planned sewer pump station improvements at the easterly end of the walkway. Other opportunities may include collaboration with improvements to the Waterfront Walkway like the potential extension further up the Penobscot River to the north and west, pedestrian improvements connecting sidewalks on Main Street to the Waterfront Walkway, waterfront marina / pier improvements, etc.

- The Town may want to consider improvements to either elevate the site, further armor the shorefront or make the walkway and area amenities more resilient to mitigate risk of impacts to the area from future predicted coastal flooding and sea level rise.

- All of these improvement opportunities will require further design development, coordination with regulatory agencies, and funding for design, permitting, and eventual construction.

- Regulatory permits are anticipated to be required for shorefront stabilization and erosion control improvements along Bucksport's Downtown riverfront. The lead

agencies and permit considerations associated with the recommended improvements are listed under *Section 1.3 Design Development and Permitting*.

Amendments to existing permits may be applicable, pending further discussions with MaineDEP during design development. Moving forward into design development, it will be necessary to continue to engage lead and sub regulatory agencies in design development.

## 1.3 Design Development and Permitting

The following is a brief description of the design development and regulatory permitting steps that are often involved with coastal resiliency projects involving improvements to public infrastructure assets:

*Site Survey*

Pending availability of existing boundary, topographic, bathymetric and as-built survey data, and any significant changes to the area since that data was last updated, additional survey work may be necessary to obtain through a Maine Licensed Land Surveyor.

*Field Investigations*

Undertake an assessment of environmental impacts associated with work either in or adjacent to the Penobscot River, along the shorefront and within adjacent upland areas. This task may be supported by wetland scientists and wildlife biologists to provide the basis of an environmental assessment.

Complete an investigation of subsurface conditions to obtain the parameters necessary to analyze:

- The quality and depth of native soils where shorefront stabilization improvements are made by elevation using fill and/or retaining / flood walls.
- Depth to ledge throughout the Waterfront Walkway corridor.

Review the presence and extent of historic and archaeologically significant sites as may be required by federal funding agencies and environmental regulatory authorities.

*Design Development*

Hold public participation meetings throughout each phase of design development to confirm continued support for the project goals and to solicit detailed feedback on the design elements proposed. This could include changes to the development of the shorefront stabilization projects in light of other community improvements within the Waterfront Walkway area.

Review the impacts of new construction with adjacent property owners to convey an understanding of the benefits of the resiliency improvement projects along the downtown waterfront that will likely require cooperation to work on private properties.

Consider the needs for operations and maintenance of the facilities and confirm local resources available / needed to ensure their performance with user assistance as needed going forward.

Complete preliminary designs for the prioritized improvement project(s) in support of funding applications for construction activities.

Once funding is secured, assess strategies as necessary to construct the project(s) in phases with consideration of adaptation and expansion of the infrastructure to accommodate potential future increases in flood risks as funding allows.

Develop 75% final design plans for submission to permitting authorities for approval(s) as applicable.

Continue one-on-one contact with affected landowners, and work to obtain rights to construct the project prior to permit approvals and often prior to receiving funding from State and Federal agencies.

*Permitting*

Facilitate pre-application meetings with Local, State and Federal regulatory representatives to discuss permit requirements for the project(s).
File applications with property owner and stakeholder support.

***Local***

The Town of Bucksport is subject to local regulations as administered by the Town's Codes Enforcement Officer and Planning Board. The following Town permits may be required:

- Land Use / Building Permit
- Flood Hazard Permit

***State***

- The MaineDEP is the clearing house for all state agencies that are concerned with the impact of the proposed projects on freshwater wetlands, and coastal wetlands and intertidal areas. These projects are subject to permitting under the Natural Resources Protection Act (NRPA). The following MaineDEP permits may be required:

  a. Improvements to the shorefront and adjacent upland developed areas are eligible for an NRPA Permit-By-Rule (PBR) for:

     - Activities Adjacent to an NRPA Resource

- Replacement of Structures
- Outfall Pipes

b. An NRPA Individual Permit will be required projects impacting coastal wetlands additional shorefront armoring beyond the highest annual tide level, and for shorefront stabilization and stormwater handling improvements beyond repairing existing structures.

***State / Federal***

- The Federal Emergency Management Agency (FEMA) and Maine Emergency Management Agency (MEMA) will coordinate the certification review of any Flood Map changes that develop as a result of improvements to the Waterfront Walkway area within effective mapped FEMA Flood Zones.

***Federal***

- The New England District of the U.S. Army Corps of Engineers (ACOE) regulates construction and other work in navigable waterways under Section 10 of the Rivers and Harbors Act of 1899, and has authority over the discharge of dredged or fill material into "waters of the United States", including all wetlands, under Section 404 of the Clean Water Act. A Program General Permit may be required for:

US Army Corps of Engineers

a. Reconfiguration of and/or fill associated with the shorefront stabilization and/or stormwater outfall pipes that impact the Penobscot River.

## 1.4 Construction, Operation and Maintenance

Once design, permitting and construction funding efforts are complete, the Town will prepare contract documents for bidding and constructing the project(s). These documents should include funding and regulatory permit requirements for reference during the construction period, as well as any funding program requirements.

After contract documents are in place the Town will likely facilitate a public bid process and invite qualified contractors to bid on the work.

After selection of a qualified, responsive and responsible bidder, approved by funding agencies as required and a contract is executed, the Town should be prepared to provide on-site observation representatives and/or third party inspectors to document the project work, review quality control inspections, testing of materials and means of construction.

Additionally, the Town should be prepared to respond to contractor requests for information, review contractor payment applications, and perform personnel interviews as may be necessary to meet funding agency requirements.

After construction is substantially completed the Town will review the construction work with the contractor, permitting agencies and funding agencies, and develop a final punchlist of items necessary to complete to satisfy final payment and release of contractor bonds and insurance certificates.

The Town should continue to monitor and maintain the public infrastructure facilities annually with period maintenance and operations as required at a minimum, in preparation for and immediately after significant storm events.

## 1.5 Planning Level Construction Cost Estimates

Some of the recommended improvements may involve minimal costs, such as Town administrative costs to coordinate with private property owners / MaineDOT to address erosion issues that may not be the responsibility of the Town to fund for construction.

Other improvements such as stormwater handling in areas owned by the Town could range in costs from tens of thousands of dollars to around one-hundred thousand for subsurface drainage systems.

Vegetative buffer improvements are anticipated to cost approximately $25 to $50 per square yard.

Shorefront stabilization improvement such as placement of additional riprap or creation of a flood wall / levee system could have a wide range of costs and should be assessed in further detail after more design development work is completed. Approximate linear foot costs could range from hundreds of dollars per linear foot to between one to two thousand dollars per linear foot.

Potential project specific costs in general, including those noted above as well as costs to make site amenities more resilient, to elevate upland areas, and / or to provide additional stone armoring above the existing embankment will require further detailed site survey information and design development.

Survey, environmental assessments, geotechnical engineering and coastal / site engineering efforts can also vary depending on the scope of construction improvements and complexities of the design. It is typical for these fees to be between 5% to 15% of total construction costs for design and permitting. Bidding and construction administration assistance are often between 10% to 20% of construction costs.

## 1.6 Potential Implementation Funding Sources

Further studies, design development, permitting, construction, and operations and maintenance for the recommended shorefront improvements often need significant capital investment to implement. A well-defined local capital improvement program is essential to prepare funding applications to a variety of competitive sources. These grant / loam programs often include state and federal programs with annually renewed capital resources, and sometimes include less frequent funding opportunities such as state bonds.

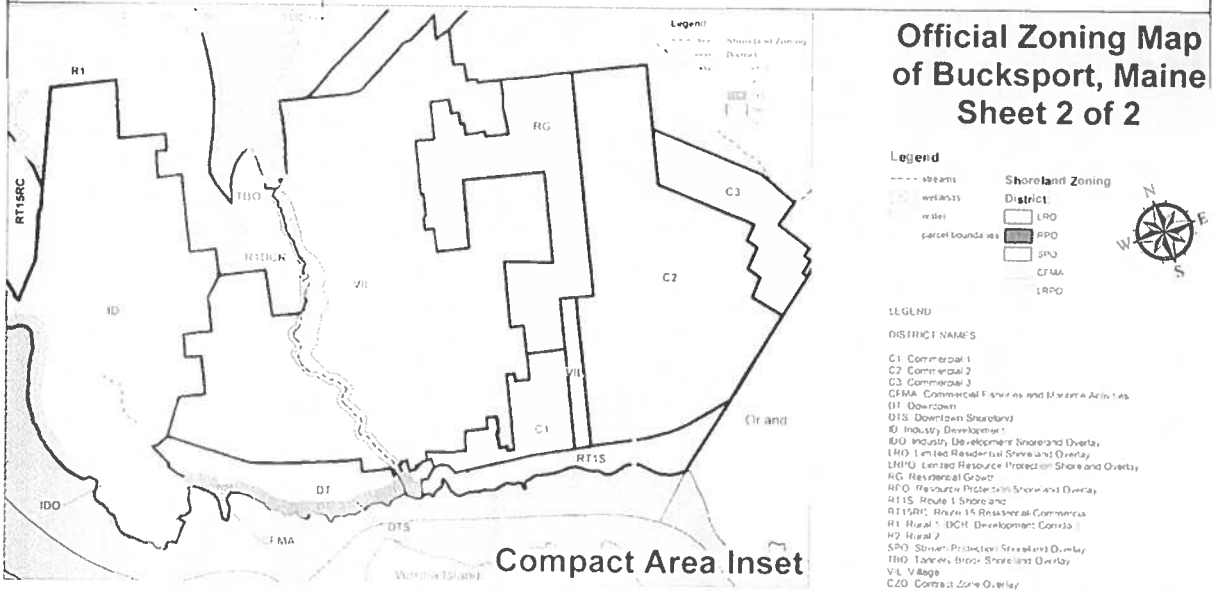
Note that there are outstanding federal funds through the 2021 Coronavirus Aid, Relief, and Economic Security (CARES) Act and subsequent 2022 Infrastructure Investment and Jobs Act (IIJA), along with recent congressional earmarks are becoming available through new and existing administration programs. Some of the newer opportunities this year have included the Maine Governor's Office of Policy, Innovation and the Future's Community Action Grants new funding programs, and MaineDOT's one-time (to-date) spring of 2022 Maine Infrastructure Adaptation Fund program. The Town should continue to monitor opportunities to pursue these new federal funding sources. The following is a brief list of potential funding sources for Bucksport to consider. They are organized by Federal (Fed), State, or "Other" sources (i.e. Private / Non-Profit sources), in terms of funding order of magnitude ranges and whether or not there is a local cost share requirement:
(Small = $500 to $50,000 / Medium = $50,000 to $250,000 / Large = $250,000 to $1M+)

| Title | Source | Eligible Activities | Size | Cost Share (Y/N) |
|---|---|---|---|---|
| **Community Action Grants** | State | Municipal projects that make their community more resilient to climate change effects | Sm | Y |
| **Recretional Trails Program** | Fed | Development and maintenance of recreational trails and trail-related facilities. | Sm/Med | Y |
| **Shore & Harbor Planning Grant** | Fed | Harbor, working waterfront & municipal facilities planning & design, ROW rediscovery | Sm | Y |
| **Coastal Community Grant** | Fed | Coastal water quality, resiliency, habitat, sustainable dev. & coastal-dependent econ. | Sm/Med | Y |
| **Community Development Block Grant Program** | Fed | Community infrastructure, housing, downtown revitalization, public facilities & econ. dev. | Sm/Med /Lg | Y |
| **Pre-Disaster Mitigation Assistance Program** | Fed | Sustained actions to reduce or eliminate long-term risk from natural hazards | Sm/Med /Lg | Y |
| **Flood Mitigation Assistance** | Fed | Projects that reduce or eliminate long-term risk of flood damage to structures under NFIP | Sm/Med /Lg | Y |
| **National Coastal Resilience Fund** | Fed | Coastal community key infrastructures assets, water quality, recreation & ecosystems | Sm/Med /Lg | Y |

# Assessment Information

## 2.1 General Project Information

| | |
|---|---|
| **Client** | Town of Bucksport, Maine<br>Project Manager: Rich Rotella<br>Community & Economic Development Director |
| **Location** | Waterfront Walkway, Penobscot River, Bucksport, ME |
| **Coordinates** | 44°34'16.00"N, 68°47'36.00"W (Approximate Midpoint of Walkway) |
| **Tax Map / Lot** | The Waterfront Walkway crosses 23 properties and MaineDOT's U.S. Route 1 right-of-way, as indicated on the Town's Tax Maps 29, 32 and 34. Some of these lots are owned by the Town, while others are private properties with easements in place for the walkway. |
| **Project Area** | The Waterfront Walkway is approximately one (1) mile in length, with end points at Steamboat Wharf Lane to the west and at U.S. Route 1 (Main Street) to the east of the current Irving Gas Station. The walkway is located in Bucksport's Downtown, between Main Street to the north and the Penobscot river to the south. The walkway area is approximately 5 acres. |
| **Zoning District(s)** | Downtown Shoreland Zone (DTS) |




*Portion of Town of Bucksport Official Zoning Map (Effective February 21, 2019)*

*The Project Area Extends the Full Length of the Downtown Shoreland (DTS) Zone*

| | |
|---|---|
| **Reference** | The Town of Bucksport contacted GEI during April of 2022 and presented photos of recent erosion issues along the Waterfront Walkway. These issues were primarily focused around the eastern end of the walkway in the area behind the Irving Gas Station. The Town had also identified additional areas of erosion along the length of the walkway, and concerns of potential for flooding due to coastal storm surge and sea level rise, or for erosion from coastal and upland flooding and runoff.<br><br>The Town of Bucksport requested GEI's assistance with evaluating the erosion issues and providing guidance regarding potential erosion control improvements that the Town could consider for implementation.<br><br>Travis Pryor and Dan Pelletier of GEI visited the site on May 25, 2022 to review the waterfront walkway conditions. GEI was accompanied by Rich Rotella, Like Chiavelli (Codes Enforcement Officer), Michael Ormsby (Harbor Master), Jay Lanpher (Public Works Director) David Michaud and Chris Remick (Maine Water Company).<br><br>During June of 2022, the Town of Bucksport provided GEI with subsequent photos depicting erosion control improvement measures constructed at the Irving Gas Station (31 Main Street). |

## 2.2 Elevations*

** All elevations in this report reference vertical datum NAVD 88 unless otherwise noted.*

| | |
|---|---|
| **NOAA** | Tidal Benchmark Reference Station 8413320 "Bar Harbor, ME"<br><br>Tidal Subordinate Station 8414684 "Bucksport" |
| **FEMA** | Zone VE, Elevation 12 (Steamboat Wharf Lane to the current Bob Hoffman Real Estate property – 26 Main Street)<br><br>Zone VE, Elevation 11 (Current Bob Hoffman Real Estate property – 26 Main Street to current Irving Gas Station property – 31 Main Street) |
| **MaineDEP** | Highest annual tide elevation obtained from the latest published Maine Department of Environmental Protection's data in 2018. |

## Project Elevations

PROJECT ELEVATIONS (BY DATUM)

| ELEVATION | NOAA MLLW (ft) | NAVD88 (ft) | Notes |
|---|---|---|---|
| Waterfront Walkway (Avg. Est. Grade) * | 17.4 | 11.0 | Maine LiDAR 2-FT Contour Data |
| FEMA Base Flood | 18.4 | 12.0 | June 20, 2016; 100-Yr FEMA Zone VE (Steamboat Wharf Ln to 26 Main St) |
| FEMA Base Flood | 17.4 | 11.0 | June 20, 2016; 100-Yr FEMA Zone VE (26 Main St to 31 Main St) |
| Highest Annual Tide | 13.8 | 7.4 | MaineDEP HAT Levels for 2018 "BUCKSPORT" |
| MHHW | 11.5 | 5.1 | BASED ON TIDAL SUBTATION 8414684 "BUCKSPORT, ME" AND REFERENCE STATION BM 813320 "BAR HARBOR, ME" |
| MHW | 11.1 | 4.6 | |
| NAVD88 | 6.4 | 0.0 | |
| NGVD29 | 7.1 | -0.7 | |
| MLW | 0.4 | -6.0 | |
| MLLW | 0.0 | -6.4 | |

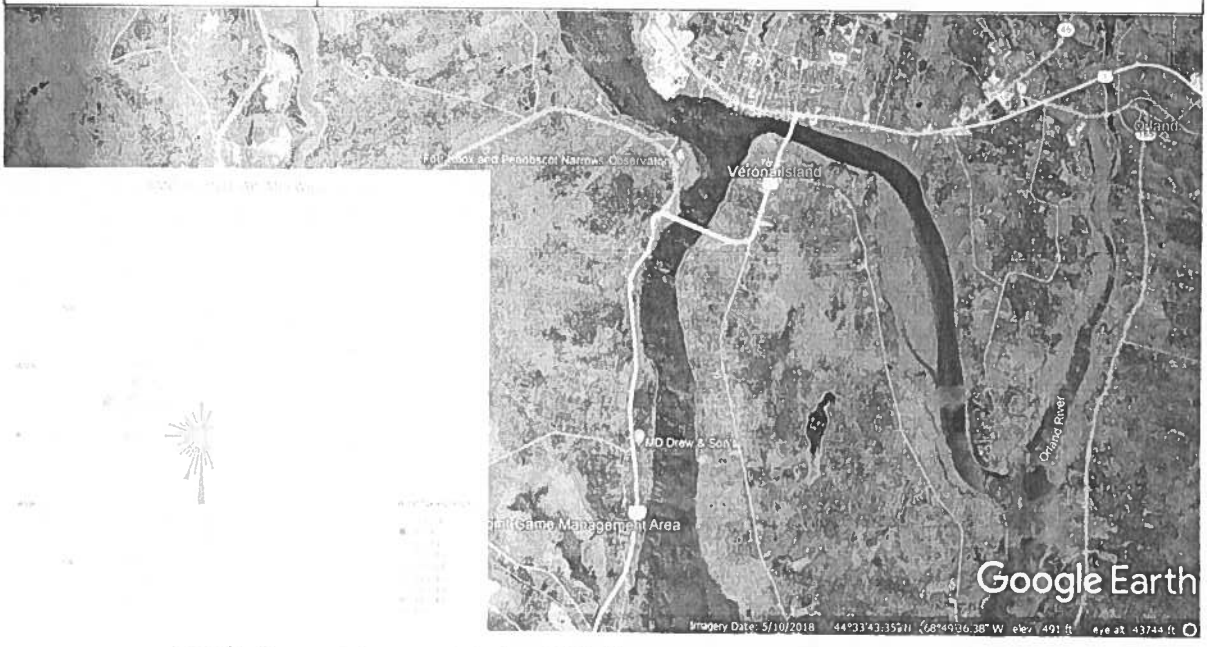
1. BASE FLOOD INFORMATION TAKEN FROM FEMA FLOOD INSURANCE RATE MAPS
2. HIGHEST ANNUAL TIDE TAKEN FROM MAINE DEP PUBLISHED PREDICTIONS FOR NAVD88 AND MLLW DATUMS
3. TIDAL INFORMATION TAKEN FROM NOAA PUBLISHED DATA FOR MLLW DATUM
4. NOAA VertCON CONVERSION FROM NGVD29 TO NAVD88 AT PROJECT LOCATION (LAT 44DEG 34MIN 16.00SEC, LON 68DEG 47MIN 36.00SEC) IS -0.716
5. HEIGHT OFFSETS FROM REFERENCE STATION BAR HARBOR ARE HIGH: 1.01 AND LOW: 1.00
6. AVERAGE ESTIMATED WATERFRONT WALKWAY ELEVATION BASED ON LiDAR

** Waterfront Walkway estimated average elevation grade at 11-feet is based on review of Maine LiDAR contour data, "Combined Sewer Overflow Abatement" 2007 plans by Wright-Pierce and "Topographic Survey: 94 Main Street" 2020 plan by Little River Land Surveying, Inc. The majority of the Waterfront Walkway grade is at or just below 11-feet. The grade rises in the middle of the walkway to approximate elevation 23-feet and at the easterly end to approximate elevation 23-feet.*


*Maine Geological Survey Web LiDAR Mapping Data Image Clip*

## 2.3 Existing Shorefront

| | |
|---|---|
| **Upland** | The upland area is significantly developed as a mix of urban uses. These include buildings, parking and access drives, the Waterfront Walkway, railroad, pedestrian and vehicular bridges, landscape and lawn areas, passive park space, and a variety of site amenities (lighting, benches, memorials, etc.)<br><br>There is a significant drop in grade from Main Street to the Waterfront Walkway area, between 15 to 20 feet in most places, followed by a relatively flat area including the Waterfront Walkway, within 25 to 50 feet of the top of the shorefront embankment.<br><br>Some upland properties include vegetated slopes between the upland and walkway, while in other locations where development is set back less from shore there are retaining walls of various heights that make up differences in grade between the walkway and upland. |
| **Exposure** | The southerly orientation of the shorefront site, approximate 3.5 miles upriver from Penobscot Bay leaves the area fairly well protected from seasonally prevailing winds from the north and west, with limited exposure to seasonally prevailing winds from the south given the winding river segment below downtown Bucksport flowing into Penobscot Bay.<br><br>The downtown area is at the confluence of the Penobscot and Orland, and experiences significant changes in currents from the rivers and coastal tide conditions. Town staff reported that this area has not recently experience significant impacts from seasonal ice floes. |




*Google Earth Aerial Image / cli-MATE Wind Rose Chart (Dec 1941 – Sept 2022)*

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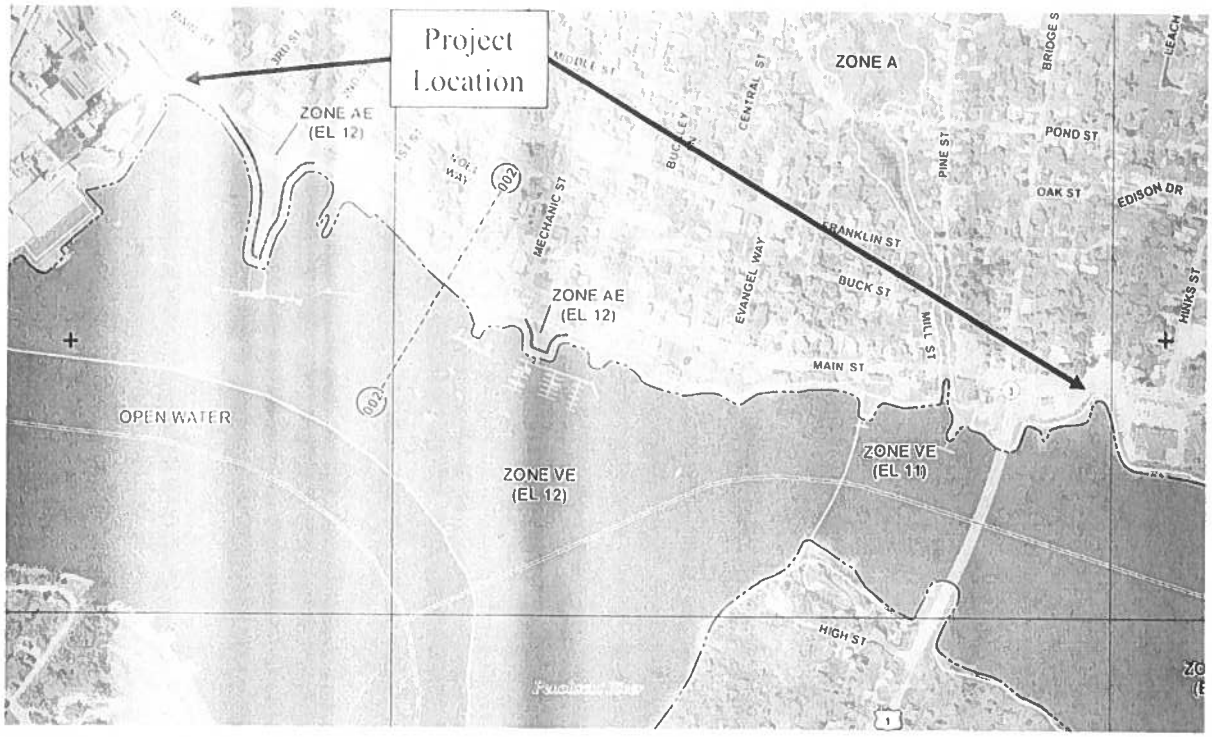
| **Flooding & Sea Level Rise** | The majority of the waterfront walkway is mapped by FEMA as being located within a Special Flood Hazard Area (SFHA), or an area predicted to be subject to flooding due to the Base Flood Elevation (BFE), which represents the 1% annual chance water elevation. It is important to note that flood events can and do occur in excess of the BFE, and that even areas located beyond the mapped SFHA can be at risk of flooding during severe flood events.<br><br>Based on effective (2016) FEMA mapping, the BFE is 12-ft for the portion of the area west of 26 Main Street (Hoffman Property – Tax Map 32 Lot 7) and 11-ft for the portion east of this property. A coastal transect is located approximately at 26 Main Street.<br><br>Based on readily available LIDAR contour data, the top of the embankment is at approximate elevation 10-ft and the majority of the walkway is at approximate elevation 11-ft, which indicates that the embankment and portions of the adjacent upland could be overtopped during a 100-year flood event based on the FEMA flood elevations noted above. Such events could cause erosion of the embankment and immediately adjacent upland areas, especially given their classification as V-zones which indicates calculated wave heights with a minimum height of 3-feet impacting the area during a 100-year flood event.<br><br>Sea Level Rise (SLR) has been occurring at a historic rate of 0.62-Ft per 100 years as measured at NOAA's Portland, Maine tidal station and climate change models predict a range of SLR rates going forward, almost all of which indicate increases in sea level elevation. SLR is likely to add increased risk to the shoreline in addition to the potential impacts from periodic floods.<br><br>The Maine Climate Council's "Maine Won't Wait; A Four-Year Plan for Climate Action" report dated December 2020, has recommended that the state and its communities "Commit to Manage" for 1.5 feet of relative SLR by 2050 and "Prepare to Manage" for 3.9 feet of relative SLR by 2100. These recommendations are expected to continue to influence projects receiving state and federal funding for public infrastructure improvements, where communities will have to consider options to mitigate risks of additional coastal flooding above the 100-Year BFE that accommodate additional sea level rise by 2050, and that are adaptable to mitigate additional SLR elevation risks by 2100.<br><br>With the addition of the values of SLR recommended by the Maine Climate Council, the waterfront walkway could be subject to more frequent storm overtopping by 2050, and overtopping during spring tide events (highest annual tide) by 2100. |




*Portion of Effective FEMA Flood Map*

| **Surficial Geology** | The pattern of glacial sediments as mapped by Maine Geological Survey (MeGS) indicates *Till* formations present on the majority of the project area, with some areas of *Artificial Fill* along and adjacent to the western side of the Waterfront Walkway, and *Presumpscot* formation present to the east of the Waterfront Walkway. *Presumpscot Formation* is defined as a "sensitive clay" that can deform and flow when disturbed or left unsupported, leading to landslides. The rest of the areas soils are considered fairly stable and at low risk to landslides. |
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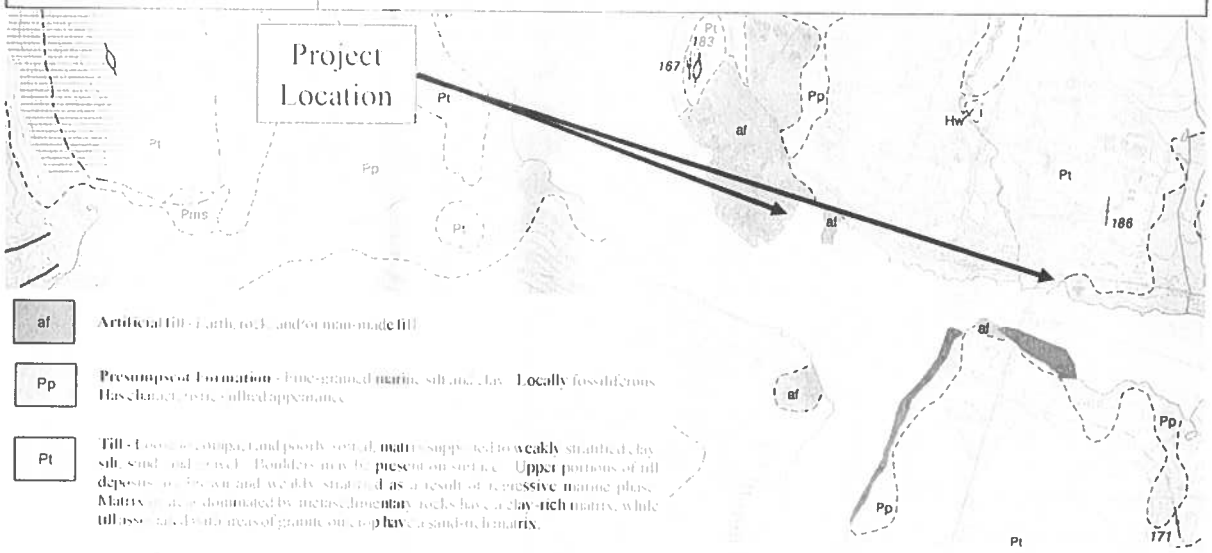


*Portion of MeGS Surficial Geology Map, Bucksport Quadrangle, 2013*

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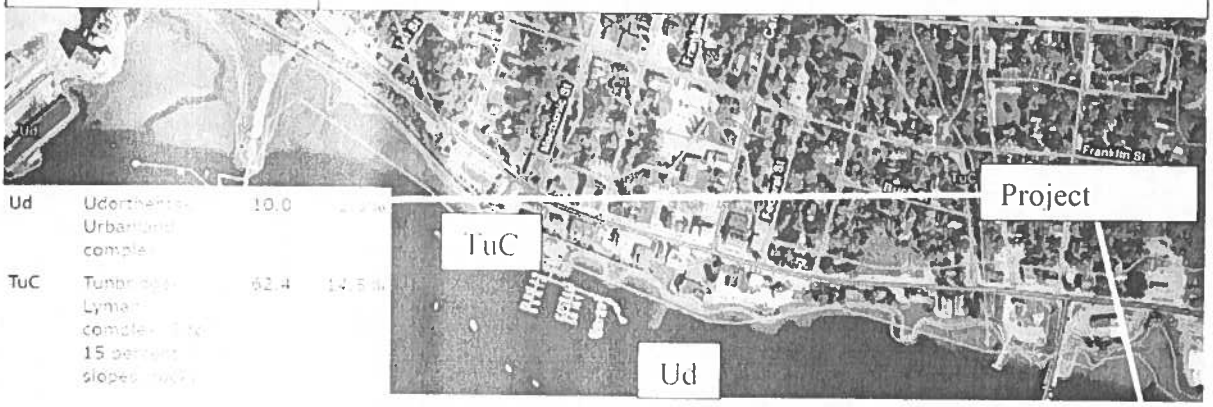
| **Soils** | County level soils mapping indicates the presence of *Udorthents-Urbanland Complex* throughout most of the property. This soil is typically up to 5 feet deep with slopes between 0 to 3 percent, moderately well drained, very gravelly sandy loam material. Generally, this soil condition indicates a more stable slope, as landslide-prone bluffs tend to consist of clay sediments. A small portion of the upland on the westerly side of the area is indicated as *Tunbridge-Lyman Complex C*. This material is well drained material, up to 2-3 feet deep. |




*USDA NRCS – County Level Soils Map*

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| **Shoreline** Toe & **Intertidal** Zone | The toe of the shorefront is mostly armored with angular riprap stones in a range of sizes between 6 to 24 inches.<br>The intertidal zone is predominantly mudflats beyond the toe stone, with limited areas of rockweed growing over the toe stones. |
| **Vegetation** | Most of the vegetated surfaces in the area are lawn. There are some stands and individual trees throughout the project area, as well as shrubs and landscape beds at the backs of the buildings and along the top of the embankment. There are a mix of native and non-native species, with no significant invasive species colonies observed. |
| **Utilities** / Drainage | There are subsurface utility systems in the area including:<br>• A sewer collection system follows the edge of the shorefront embankment throughout the project area.<br>• Water and electrical service lines from Main Street cross the area at several locations.<br>Some stormwater flows, mostly from Main Street, are collected in subsurface conveyance systems and discharged through outfalls in the shorefront embankment. |

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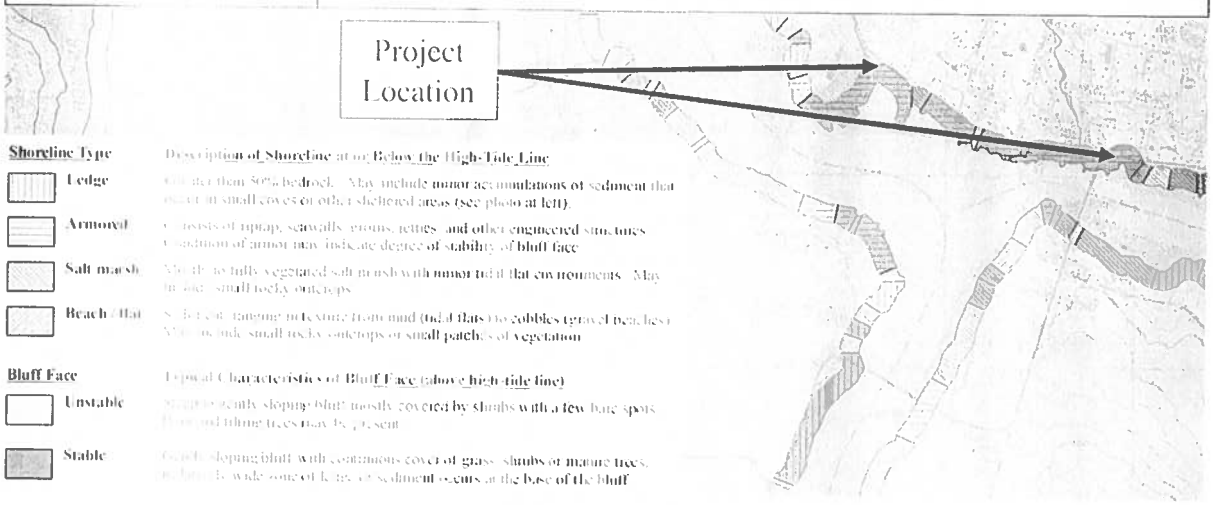
| **Structures** | There are a variety of built structures along the downtown waterfront.<br>• The majority of the structures in the area are a mix of civic and commercial buildings along Main Street.<br>• Other significant structures include piers, docks, a pedestrian bridge, retaining walls and the vehicular bridge crossing of Route 1 to Verona Island. There are also currently vacated railroad lines on the westerly end of the Waterfront Walkway.<br>The Waterfront Walkway itself is an at-grade unit paver surface, approximately 6 feet wide and extending the full length of the downtown waterfront shoreland zone, approximately 1-mile. |
| **Embankment / Coastal Bluff** | Most of the embankment is armored with angular riprap stones with average dimensions between 6 to 24 inches. A small portion to the west has a stacked stone block retaining wall. The easterly end has a portion with small intermittent angular riprap stone areas and vegetated embankment elsewhere.<br>MeGS has mapped portions of the area's shorefront as either *Stable* or *Unstable Coastal Bluff*. Most of the area is classified as *Stable* and there is a small area towards the westerly area that is classified as *Unstable*. Based on our observations, it is not readily apparent why the *Unstable* classification is noted.<br>The area has been classified as *Low Coastal Bluff* by MeGS in consideration of landslide potential which indicates that the area is unlikely to be at risk of such slope failure. |




*Portion of MeGS Coastal Bluff Map, Bucksport Quadrangle, 2002*

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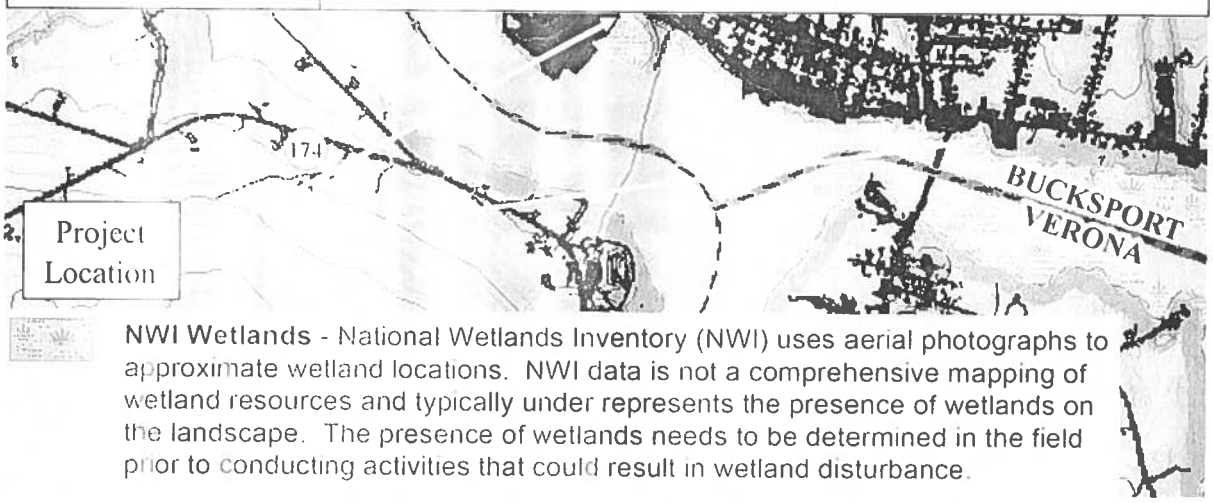
| **Plant & Animal Habitat** | Maine's Beginning with Habitat (BWH) program provides screening-level site assessment mapping of high value plant and animal habitats (Rare, threatened and endangered species, and important and sensitive habitats). This data helps to identify environmentally sensitive areas that may have regulatory restrictions. BWH mapping indicates the presence of Tidal Wading Bird and Waterfowl Habitat, as well as National Wetland Inventory areas. Bald Eagles nest(s) are adjacent to the area. |




NWI Wetlands - National Wetlands Inventory (NWI) uses aerial photographs to approximate wetland locations. NWI data is not a comprehensive mapping of wetland resources and typically under represents the presence of wetlands on the landscape. The presence of wetlands needs to be determined in the field prior to conducting activities that could result in wetland disturbance.

*Portion of Beginning With Habitat Primary Map 1 – Water Resources & Riparian Habitat, March 2015*


Tidal Waterfowl / Wading Bird

Breeding, migrating/staging, or wintering areas for coastal waterfowl or breeding, feeding, loafing, migrating, or roosting areas for coastal wading birds. Tidal Waterfowl/Wading Bird habitats include aquatic beds, eelgrass, emergent wetlands, mudflats, seaweed communities,

*Portion of Beginning With Habitat Primary Map 2 – High Value Plan & Animal Habitat, March 2015*

## 2.4 References

- Town of Bucksport Comprehensive Plan, dated April 20, 2017.
- Bucksport Town Code; Appendix 24; K - Land Use
- Bucksport Town Zoning Map, dated February 21, 2019.
- Bucksport Tax Maps, dated February 23, 2021.
- 2007 "Combined Sewer Overflow Abatement" drawing as developed by Wright-Pierce for the Town of Bucksport.
- Federal Emergency Management Agency Flood Insurance Rate Map Panel 0683D, Bucksport, Town of and Verona Island, Town of; dated July 20, 2016.
- Midwest Regional Climate Center – cli-Mate Wind Rose data.
- Maine Geological Survey – Lidar contour; coastal bluff and surficial geology data.
- Maine Beginning With Habitat mapping.
- USDA Natural Resources Conservation Service – County Level Soil Survey data.

# Appendix A

## A1 Existing Erosion Areas of Concern Map

## A2 Recommended Improvement Areas Map

# Appendix B

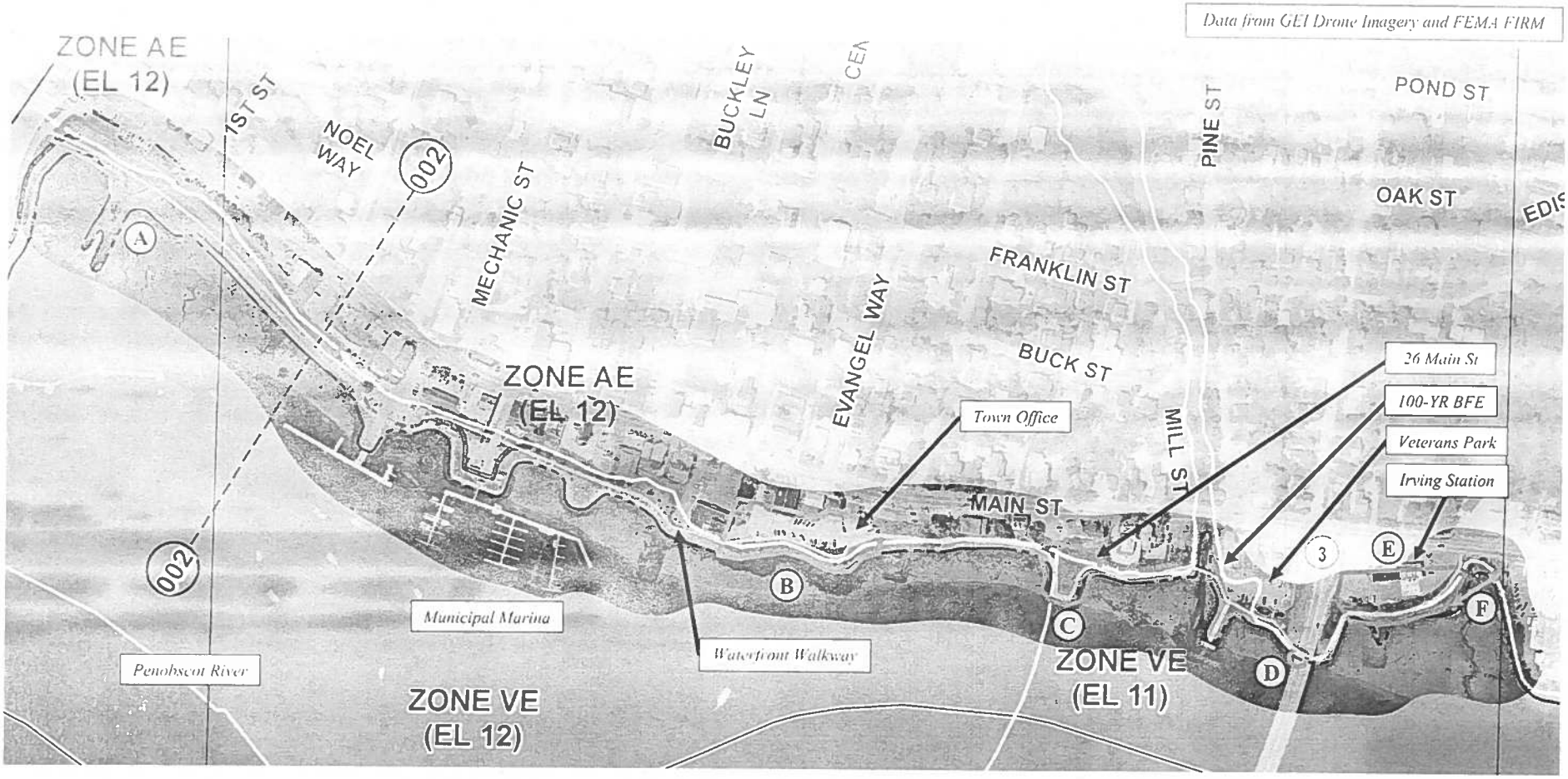
## Walkway Reroute Renderings

B1 – Aerial Overview

B2 – View Looking East

B3 – View Looking West

## Existing Erosion Areas of Concern Map




**A** SURFACE EROSION IMPACTS FROM RAILROAD SIDING AREA

**B** SURFACE EROSION IMPACTS FROM PARKING LOT

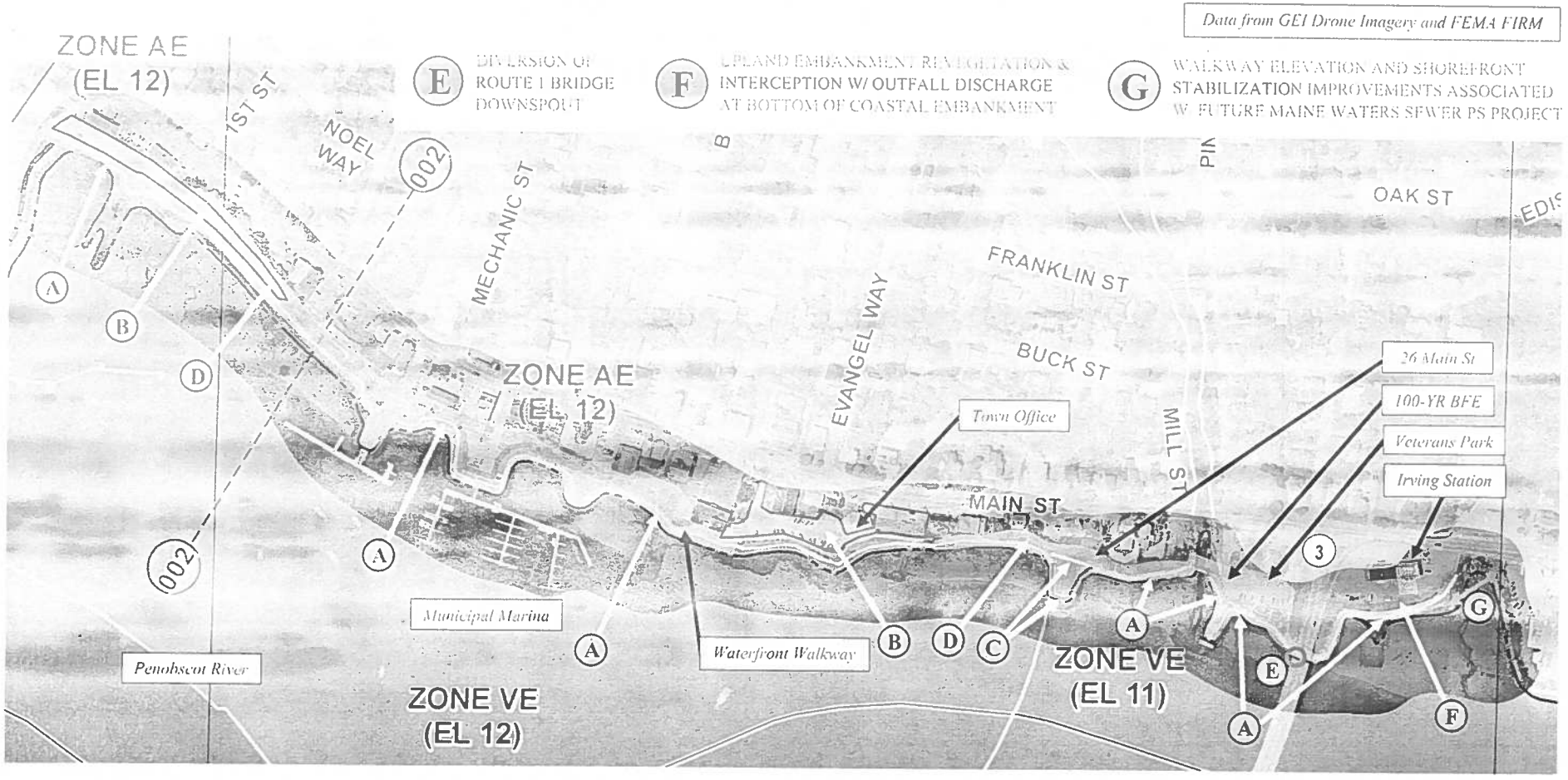
**C** SHOREFRONT EROSION AROUND POINT

**D** DOWNSPOUT DRAINAGE IMPACTS FROM RTE 1 BRIDGE

**E** SURFACE EROSION IMPACTS FROM IRVING STATION

**F** FUTURE MAINE WATERS SEWER PS PROJECT AREA

## Recommended Improvement Areas Map




**A** VEGETATIVE BUFFER BETWEEN WALKWAY & STONE ARMORED SHOREFRONT

**B** UPLAND STORMWATER SURFACE FLOW INTERCEPTION W/ OUTFALL DISCHARGE AT BOTTOM OF COASTAL EMBANKMENT

**C** WALKWAY REROUTE OPTION & ADDITIONAL STONE ARMORING OF COASTAL EMBANKMENT

**D** SITE ELEVATION, ADDITIONAL COASTAL EMBANKMENT ARMORING AND/OR INCREASED AMENITIES RESILIENCY